

CLAIMS:

1. A method for determining the number of cylinders and valves to operate in an internal combustion engine with electromechanically actuated valves, the method comprising:
  - determining an operating condition of said internal combustion engine;
  - selecting a number of cylinders in which to carry out combustion, based on said operating condition;
  - determining a number of electromechanically actuated valves to operate in said selected cylinders; and
  - operating said number of electromechanically actuated valves in said selected cylinders during a cycle of said internal combustion engine.
2. The method of Claim 1 wherein said operating condition is an engine temperature.
3. The method of Claim 1 wherein said operating condition of said internal combustion engine is a time since start of said internal combustion engine.
4. The method of Claim 1 wherein said operating condition of said internal combustion engine is a number of fueled cylinder events of said internal combustion engine.
5. The method of Claim 1 wherein said operating condition is a desired torque of said internal combustion engine.

6. The method of Claim 1 wherein said operating condition is a predicted desired torque of said internal combustion engine.
- 5 7. The method of Claim 1 wherein said operating condition is a speed of said internal combustion engine.
8. The method of Claim 1 wherein said operating condition is a predicted speed of said internal  
10 combustion engine.
9. The method of Claim 1 wherein determination of said number of electromechanically actuated valves is based on said selected number of cylinders.
- 15 10. The method of Claim 1 wherein said operating condition is a temperature of said electromechanically actuated valve.
- 20 11. The method of Claim 1 wherein said operating condition is an engine oil temperature.
12. The method of Claim 1 wherein said engine operating condition is a temperature of at least one catalyst  
25 brick.
13. The method of Claim 1 wherein said operating condition is an amount of emissions produced by said internal combustion engine.
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14. A method for determining the number of cylinders and valves to operate in an internal combustion engine with electromechanically actuated valves, the method comprising:

- 5                   determining an operating condition of said internal combustion engine;
- selecting a number of cylinders in which to carry out combustion, based on said operating condition;
- determining a number of electromechanically
- 10   actuated valves to operate in said selected cylinders;
- selecting a first electromechanically actuated valve pattern based on said determined number of electromechanically actuated valves;
- selecting a second electromechanically actuated
- 15   valve pattern based on said determine number of electromechanically actuated valves; and
- alternately operating said first electromechanically actuated valve pattern in said selected cylinders during a cycle of said selected
- 20   cylinders and operating said second electromechanically actuated valve pattern during different cycles of said selected cylinders.

- 15. The method of Claim 14 wherein said different cycles
- 25                   are every other cycle of said cylinders.

16. A control method for selecting and controlling cylinders and valves in an internal combustion engine, the method comprising:

5 a first mode of operation to select and deactivate a first number of cylinders, and to carry out combustion in the remaining cylinders with a first number of active valves; and

10 a second mode of operation to select and deactivate a second number of cylinders, and to carry out combustion in the remaining cylinders with a second number of active valves.

17. The method of Claim 16 wherein said first number of cylinders are zero.

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18. The method of Claim 16 wherein said first number of active valves and said second number of active valves form different valve patterns.

20 19. The method of Claim 16 wherein said first number of active valves and said second number of active valves form the same valve pattern.

20. A method for determining the number of cylinders to operate in an internal combustion engine with electromechanically actuated valves, the method comprising:

- 5                   determining an operating condition of said internal combustion engine;
- selecting a number of cylinders to operate based on said operating condition;
- determining a number of electromechanically
- 10 actuated valves to operate in a first and a second group of cylinders located within said number of selected cylinders; and
- operating said number of electromechanically actuated valves in said first and second group of
- 15 cylinders during a cycle of said internal combustion engine based on said determination.

21. The method of Claim 20 wherein said operating condition is an engine temperature.

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22. The method of Claim 20 wherein said operating condition of said internal combustion engine is a time since start of said internal combustion engine.

25 23. The method of Claim 20 wherein said operating condition is a desired torque of said internal combustion engine.

24. The method of Claim 20 wherein said operating

30 condition is a speed of said internal combustion engine.

25. The method of Claim 20 wherein determination of said number of electromechanically actuated valves is based on said selected number of cylinders.

5 26. The method of Claim 20 wherein said operating condition is a catalyst operating condition of at least one brick of a catalyst system.

27. The method of Claim 20 wherein said engine operating  
10 condition is a temperature of at least one catalyst brick.

28. The method of Claim 20 wherein said operating condition is an amount of emissions produced by said  
15 internal combustion engine.

29. A method for determining the number of cylinders to operate in an internal combustion engine with electromechanically actuated valves, the method  
20 comprising:

determining an operating condition of at least one of said electromechanically actuated valves;

determining an operating condition of said internal combustion engine;

25        selecting a number of cylinders to operate based on said electromechanically actuated valve operating condition and said engine operating condition;

determining a number of electromechanically actuated valves to operate in said selected cylinder  
30 based on said number of cylinders; and

operating said number of electromechanically actuated valves in said selected cylinder during a cycle of said internal combustion engine based on said evaluation.

30. The method of Claim 29 wherein said operating condition of said internal combustion engine is an engine temperature.

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31. The method of Claim 29 wherein said operating condition of said internal combustion engine is a time since start of said internal combustion engine.

10 32. The method of Claim 29 wherein said operating condition of said internal combustion engine is a desired torque of said internal combustion engine.

15 33. The method of Claim 29 wherein said operating condition of said internal combustion engine is a speed of said internal combustion engine.

20 34. The method of Claim 29 wherein said operating condition of said electromechanical valve is a temperature of said electromechanically actuated valve.

25 35. The method of Claim 29 wherein said operating condition of said electromechanical valve is an impedance of said electromechanical valve.

36. A method for determining the number of cylinders to operate in an internal combustion engine, the method comprising:

5 determining an operating condition of at least one catalyst brick located in an exhaust system of said internal combustion engine;

selecting a number of cylinders in which to carry out combustion, based on said catalyst operating condition;

10 determining a number of valves to operate in said selected cylinders; and

operating said number of valves in said selected cylinders during a cycle of said internal combustion engine.

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37. The method of Claim 36 wherein said operating condition of said catalyst brick is a temperature of said catalyst brick.

20 38. The method of Claim 36 wherein said operating condition of said catalyst brick is an amount of oxidants stored by said catalyst brick.

25 39. The method of Claim 36 wherein said operating condition of said catalyst brick is an amount of oxidant storage capacity of said catalyst brick.



40. A method for determining the number of cylinders to operate in an internal combustion engine, the method comprising:

5 determining a constituent storage capacity of at least one catalyst brick located in an exhaust system of said internal combustion engine;

selecting a number of cylinders in which to carry out combustion, based on said constituent storage capacity;

10 determining a number of electromechanically actuated valves to operate in said selected cylinders; and

operating said number of electromechanically actuated valves in said selected cylinders during a cycle  
15 of said internal combustion engine.

41. The method of Claim 40 wherein said constituent capacity is an amount of oxidant storage capacity in said catalyst brick.

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42. The method of Claim 40 wherein said selected number of cylinders is further based on an amount of oxidants stored in said catalyst brick.

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43. The method of Claim 40 wherein said selected number of cylinders is further based on an amount of emissions produced by said internal combustion engine.

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44. The method of Claim 40 wherein said emissions of said internal combustion engine are oxides of nitrogen.

45. The method of Claim 40 wherein said emissions of said internal combustion engine are hydrocarbons.

46. The method of Claim 40 wherein said emissions of said internal combustion engine are carbon monoxide.

47. A method for determining the number of cylinders to  
5 operate in an internal combustion engine, the method comprising:

determining an operating condition of at least one catalyst brick located in an exhaust system of said internal combustion engine;

10 selecting a number of cylinders in which to carry out combustion, based on said catalyst operating condition;

determining a number of valves to operate in said selected cylinders; and

15 operating said number of valves in said selected cylinders during a cycle of said internal combustion engine.

48. The method of Claim 47 wherein said operating  
20 condition of said catalyst brick is a temperature of said catalyst brick.

49. The method of Claim 47 wherein said operating  
condition of said catalyst brick is an amount of oxidants  
25 stored by said catalyst brick.

50. The method of Claim 47 wherein said operating  
condition of said catalyst brick is an amount of oxidant  
storage capacity of said catalyst brick.

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51. A computer readable storage medium having stored data representing instructions executable by a computer to control an internal combustion engine of a vehicle, said storage medium comprising:

- 5           instructions for determining an operating condition of said internal combustion engine;
- instructions for selecting a number of cylinders in which to carry out combustion, based on said operating condition; determining a number of
- 10   electromechanically actuated valves to operate in said selected cylinders; and
- instructions for operating said number of electromechanically actuated valves in said selected cylinders during a cycle of said internal combustion
- 15   engine.

52. A method for operating an internal combustion engine with electromechanically actuated valves, the method comprising:

- 20           operating the engine in a first mode with a first number of cylinders deactivated, and a first number of valves operating to carry out combustion in active cylinders; and
- operating the engine in a second mode with a
- 25   second number of cylinders deactivated, and a second number of valves operating to carry out combustion in active cylinders, where said first number of cylinders deactivated is different from said second number of
- cylinders deactivated, and said first number of valves
- 30   operating is different from said second number of valves operating.

53. A method for operating an internal combustion engine with electromechanically actuated valves, the method comprising:

operating the engine in a first mode with a  
5 first number of valves operating to carry out combustion in active cylinders; and

operating the engine in a second mode with a second number of cylinders deactivated, and a second number of valves operating to carry out combustion in  
10 active cylinders, where said first number of valves operating is different from said second number of valves operating.

54. The method of claim 53 where during said first mode,  
15 the engine operated with a second number of cylinders deactivated different from said first number of cylinders deactivated.

55. A method for operating an internal combustion engine with electromechanically actuated valves, the method  
20 comprising:

operating the engine in a first mode with a first number of cylinders deactivated, and a first configuration of valves operating to carry out combustion  
25 in active cylinders; and

operating the engine in a second mode with a second number of cylinders deactivated, and a second configuration of valves operating to carry out combustion in active cylinders, and said first configuration of  
30 valves operating is different from said second configuration of valves operating.

56. The method of claim 55 where said first number of cylinders deactivated are the same as said second number of cylinders deactivated.

5 57. The method of claim 55 where said first number of cylinders deactivated are different from said second number of cylinders deactivated.

10 58. A method for operating an internal combustion engine with electromechanically actuated valves, the method comprising varying a number of deactivated cylinders and varying a number of active valves in active cylinders to regulate engine output during engine operation.

15 59. The method of claim 58 further comprising varying a number of strokes of a cylinder cycle to further regulate engine output during engine operation.